

Department of Environmental Protection  
Bureau of Oil and Gas Management  
Stray Natural Gas Migration Associated with Oil and Gas Wells

Commercial oil production started in Pennsylvania in 1859 when Colonel Drake drilled the famous Drake well in Titusville. From there, petroleum production expanded further into the Venango, Southern and Bradford oil fields of Venango, Warren, McKean, Clarion, Butler and Armstrong Counties. Eventually, the oil belt extended to the southwest corner of the state in the Washington County area. During this 150-year span, hundreds of thousands of gas and oil wells have been drilled in Pennsylvania.

With the number of gas wells drilled in the Commonwealth since the inception of the industry, the potential exists for natural gas to migrate from the wellbore (via either improperly constructed or old, deteriorated wells) and adversely affect water supplies, as well as accumulate within or adjacent to structures such as residences and businesses. Collectively, this may represent a threat to public health, safety and welfare, and is a potential threat of a fire or explosion. The Department has documented such occurrences and these cases are provided in this document.

It should be noted that the Department also receives complaints of stray gas from other sources such as methane gas due to microbial processes or caused by burial of organic matter, landfills, mining activity, transmission or distribution pipeline, or natural causes. These cases are not included in this paper. The discussion in this paper is limited to gas migration cases associated with oil and natural gas wells (i.e. thermogenic in origin).

The gas migration cases are organized into several categories: new wells, operating or active wells, legacy or abandoned wells, and wells associated with underground storage of natural gas.

**New wells** involve that initial phase of an oil or gas well when the well is being drilled or re-drilled, completed and put into production. For most wells, well completion involves hydraulic fracturing either immediately after the well is drilled or at a later date.

**Operating or production wells** include wells that are actively producing. It also includes wells that the operator is not actively producing and that are not plugged.

**Legacy or abandoned well incidents** are associated with natural gas and oil wells drilled from 1859, when Colonel Drake drilled his first commercial well in Titusville, until the present and there is no responsibility operator for the well. The well may have been abandoned by the operator and not properly plugged or plugged according to the standards or practices that were in place at the time. Some of the wells were constructed under the Oil and Gas Act, which was passed in 1984 when new standards for casing, cementing and plugging wells were established. Many were not.

These cases typically involved gas migration from old wells that were abandoned without proper plugging procedures. Often, these wells are associated with the old oil and gas fields surrounding the greater Pittsburgh area or the Bradford or Venango oil fields.

***Underground Storage of Natural Gas*** includes gas migration problems associated with operating gas storage fields.

DRAFT REPORT - TAB 10/28/09

## INVENTORY OF OIL AND GAS WELL STRAY GAS CASES

### NEW WELLS – STRAY GAS MIGRATION CASES

**McNett Township, Lycoming County - East Resources – NCRO – July 2009:** A natural gas leak from an East Resources Oriskany well was confirmed on July 27, 2009. Methane gas from the well impacted multiple private drinking water wells and two tributaries to Lycoming Creek, forced one resident to evacuate her home, and required the closure of access roads near the well. Company personnel took necessary measures to stop the gas leak at the well and stream and drinking water well conditions improved. The suspected cause of the leak is a casing failure of some sort. East Resources continues to monitor homes and wells in the effected area (approximately 6000 foot + radius) where methane has been documented and reports to the Department weekly. Methane was evident in some wells and the subsurface. One gas extraction system was installed at a residence. The investigation is on-going. The Northcentral Regional office expects to receive a report regarding the incident from East Resources in approximately 30 days.

**Dimock Migration, Dimock Twp., Susquehanna County - Cabot Oil and Gas – NCRO - 2009:** The Department is actively monitoring domestic water supplies and investigating potential cause(s) of a significant gas migration that has been documented in several homes along Carter Road. Free gas has been encountered in six domestic water supplies and dissolved has been found in several of the wells. The operator has placed pilot water treatment systems on three water supplies. Of particular note is that this area has not experienced previous drilling and recent gas drilling in the vicinity has targeted the Marcellus Shale.

**Hedgehog Lane, Foster Twp., McKean County – Schriener Oil and Gas – NWRO – April 2009:** The Department is actively investigating the report of fugitive gas in domestic water well. Prior to Departmental involvement, the company drilling gas wells in the area provided a new water well to an affected residence. After stray gas was evident in the water well, apparently the concerned resident approached the company directly, a new water well was provided and the impacted well was plugged with bentonite. Some time later, neighboring water well became impacted with stray gas and the resident contacted the Department. During the investigation, four gas wells were discovered over-pressured. Packers were placed in those over-pressured wells and the wells were brought into regulatory compliance. At this time, a response in the affected water well has not been observed. Complaints of water quality degradation and water diminutions are also under investigation in the area.

**Little Sandy Creek Migration, McCalmont Twp., Jefferson County – NWRO –**

**April 2008:** In April, 2008 the Department was informed of a large fugitive expression in Little Sandy Creek. Subsequent investigation indicated the presence of combustible gas in the basement of a nearby residence. It was determined that the gas was entering the structure through an un-sealed sump opening in the concrete floor of the basement. The sump was vented through the wall and the threat to the home was minimized. During the investigation the Department discovered that two recently drilled gas wells were over-pressured and were producing from different geologic strata. Isotopic analysis indicated that a specific gas well was the probable source of the fugitive gas and measures were undertaken to reduce pressure on the casing seat. After continued monitoring at the residence, it was determined that the amount of gas in the sump was decreasing. The basement sump remains vented and the problem is dissipating.

**Kushequa Migration, Hamlin Twp., McKean County – NWRO – September 2007:**

A stray gas migration caused a change in water quality and a minor explosion in a community water well. Combustible gas was also encountered in a few private water wells within the village. The Department investigated the stray gas occurrence in September of 2007 and through an investigation determined that a specific over-pressured gas well was the cause of the migration. Pressure was released from the potentially responsible gas well and a positive change in the impacted water well was rapidly noted. Additional production casing was placed in the suspect well to permanently resolve the problem. The responsible party was recently issued a Consent Order and Civil Assessment which they plan to comply. The Department issued a well plugging contract to plug 15 orphan wells adjacent to the water wells.

**Alexander Migration, Hickory, Washington County – SWRO:** It appears the operator affected an old abandoned well when completing a new well in the area. Stray gas occurs in the soils and contamination exists in private water supplies. DEP is evaluating several wells in the area. The investigation is ongoing.

**Five Mile Run A, Knox Twp., Jefferson County – NWRO – April 2009:** The Department was made aware that on April 18, 2009 fugitive gas began escaping from a domestic water well. During the investigation, the Department also encountered combustible gas in neighboring water well. At this time evidence is being gathered and it is likely that the cause of the fugitive gas migration may be linked to a recently drilled neighboring gas well. The Department is also investigating three reports of water quality problems that may be associated with the recent gas well drilling in the area. The fugitive gas in the water well is a recent problem and at this time is not linked to the gas in Five Mile Run that is approximately 2,500 feet away.

**Five Mile Run, Knox Twp., Jefferson County – NWRO – 2008:** Consistent gas streams have been identified at two locations within Five Mile Run. Isotopic samples

were obtained in early 2008 and the analysis indicates that the gas is of thermogenic origin. It is unknown when the gas first appeared in the stream. At the time of sampling, only older historic wells (pre-1920's) were in the vicinity. Presently the area is experiencing an increase in drilling activity. The permitted boundary for the Galbraith Gas Storage Field (operated by National Fuel Gas) is located approximately 4000 feet to the closest stream expression of fugitive gas. The source of the gas at this time is unknown.

**Mix Run Migration, Gibson Twp., Cameron County – NWRO – Fall 2007:** In the fall of 2007, the Department continued the investigation of fugitive gas reported in the water well of a seasonal residence. The presence of gas in the water well is sporadic with no apparent trends in its occurrence noted. The area has experienced no recent drilling although historic records indicate Oriskany gas was produced in the vicinity. All wells that could be identified and field verified within one mile of the stray gas location are in regulatory compliance. The closest gas well was plugged and a gas well with potentially compromised casing (approximately 3000' away) was repaired. Gas was not present in the water well at the time of the last inspection in May, 2009.

**Ohl Complaint, Hebron Twp., Potter County – NWRO – June 2007:** The Department responded to a complaint of fugitive gas in a water well that serves a seasonal structure in June, 2007. Isotopic analysis indicated a possible similar thermogenic origin of the gas in the water well to a neighboring gas well. Initial efforts to vent the suspected gas well to atmosphere for an extended time failed to reduce the amount of gas in the neighboring water well. The new well owner placed a down-hole packer and additional production casing in the well. This action did not produce a reduction in the fugitive gas in the water well. The Department continues to investigate the complaint.

**Miller Gas Migration, Liberty Twp, McKean County – NWRO – January 2008:** Departmental personnel responded to a report of fugitive gas in a domestic water well that serves a seasonal residence in January, 2008. Investigation by Departmental field representatives discovered that two recently drilled gas well was over-pressured (exceeding the amount of allowable pressure on the casing seat). The operator Placed packers and additional production casing in the gas well, thereby eliminating pressure on the casing seat. The water well was aggressively pumped and over time the amount of combustible gas in the well bore decreased significantly. The gas well was brought back into production when the amount of gas was below the allowable amount.

**Head Drive Migration, Millcreek Twp., Erie County – NWRO – fall 2007.** In the fall of 2007, the Department initiated an investigation into the report of fugitive gas in the vicinity of several homes along Walnut Creek. The discovery of fugitive gas in the soil near the residences, forced the Erie County Health Dept. to evacuate the neighborhood. The residents were displaced for at least two months. Through the use of isotopic analysis and with a through investigation performed by the Department's field staff, it

was determined that the recently drilled neighboring gas wells were the cause of the migration. Through a Consent Order with the Department, the responsible party plugged two defective gas wells and placed packers in the remaining gas wells. The case is presently in private litigation.

**Hughes Migration, Hamlin Twp., McKean County – NWRO – June 2006:** In June, 2006 the Department responded to two water quality/diminution complaints and determined that a change in water quality was evident. Over-pressured conditions were noted at a recently drilled nearby gas well. The gas well operator drilled new water wells for the impacted residences and gas was encountered during the drilling process. Subsequently, when the operator placed additional production casing in the gas well, the Department noted a marked decrease in the amount of gas in the recently drilled water wells. Over time the problem has diminished.

**Foote Rest Camp Ground Migration. Hamlin Twp., McKean County – NWRO – Late 1990s:** In the late 1990's, the Department responded to a complaint of gas escaping from an abandoned gas well located in a wooded area near a private campground. During the investigation, it was discovered that an extremely large amount of gas (estimated at more than 100 Mcf/day) was venting from the abandoned gas well. The old well became activated when fracing was completed on a new gas well approximately 4000' away. Installation of production casing placed in the new well prevented additional gas from migrating to the abandoned well and the problem was resolved.

## **OPERATING WELLS STRAY GAS MIGRATION CASES**

**Harper Migration, Jefferson County – SWRO and NWRO – March 2004:** An operating gas well. House explosion resulted in three fatalities. Origin/mechanism of migration: Operating gas well. Pressurization of the annulus on one or more operating gas well(s) was the mechanism of stray gas migration that caused the explosion. Status: Final agreement pending. . Elements of DEP Compliance Order still outstanding.

**Dayton Investigation, Armstrong County – SWRO - March, 2008:** Area-wide stray gas migration. Evacuation of one residence. Newly drilled gas well was over-pressured and communicated with an abandoned gas well and other operating gas wells. Corrective action at the well resolved the problem.

Origin/mechanism of migration: Newly drilled gas well. Pressurization of surface casing resulted in migration. Frac communicated with abandoned gas well and other operating gas wells. Status: Resolved.

**Tin Town Road Migration, Monroe Twp., Clarion County – NWRO – July 2008:**

The Department became aware of fugitive gas migration that resulted in the fatality in July of 2008. Apparently, fugitive gas migrated from a very old gas well (drilled early 1900's) through the septic system and entered the bathroom of the residence. It is reported that the explosion resulted when the resident attempted to light a candle in the room. It is possible that gas migrated from the gas well through casing that over time had become compromised. The suspect gas well was vented to atmosphere and the problem dissipated. Presently, the well has been plugged by the operator and the case is in private litigation.

**Toy Migration, Armstrong County – SWRO – October 2007:** Explosion at a water well enclosure. Well pump was destroyed and damage to enclosure. No injuries. The source was a nearby operating gas well. The water well has been properly vented and is now back in service. The water well quality was affected during drilling and previously restored by the operator of the gas well. The investigation is ongoing.

Origin/mechanism of migration is a newly drilled gas well. Pressurization of the annulus on a recently drilled well was the mechanism of stray gas migration. Status: Investigation is ongoing.

**Wilson Investigation, Armstrong County – SWRO - October, 2007:** Explosion inside residence. No injuries or significant damage. Stray gas impacted private water supply well and entered home through conduit for waterline. Origin/mechanism of migration was a newly drilled gas well. Pressurization of the surface casing in newly drilled gas well. Status: Resolved

**Montgomery Migration, Hamlin Twp., McKean County – NWRO – July 2007:** A domestic water well became impacted by fugitive gas in July, 2007. With Departmental involvement, the operator of nearby gas wells initiated a program of pressure testing suspect wells and it was determined that the casing failed on a specific well. Apparently, without a check valve in the production pipeline, the suspect well was feeding pipeline gas into the gas well. The gas migrated through the compromised well casing and into the local aquifer. The operator plugged the suspect well and problem was resolved.

**Alexander Investigation, Washington County – SWRO - September, 2006:** Stray gas migration impacting several private water supplies, and surface soils. Frac in recently drilled well communicated with abandoned gas well and migrated to shallow groundwater and surface soils.

Origin/mechanism of migration: Operating gas well. Frac communicated with abandoned gas well. Abandoned gas well is constructed with wooden surface casing. Investigation reveals frac at recently drilled well created pathway to abandoned well and further migration into the shallow groundwater system. Status: Investigation is ongoing.

**703 Liberty Street Migration, Warren County – NWRO – January 2005:** Gas migrating from an operating gas well resulted in an explosion in the boiler room of the house. There were no injuries. Two nearby wells provided house gas to the residence. The problem well was identified and repaired. The investigation lasted several months.

**Chestnut Street migration, Washington County – SWRO - May, 2003:** An operating gas well resulted in fire and caused house explosions, with two injuries and an evacuation. Origin/mechanism of migration is an operating gas well had leak in casing. Status: Resolved. Gas well was repaired; outcome of the civil court case is unknown.

**Unknown name, Armstrong County – SWRO - ~ 1999:** House explosion, resulting in destruction of residence and one fatality. Investigation is not well documented. Origin/mechanism of migration is an operating gas well. Pressurization of casing. Status: Resolved

**Vtodian Investigation, Allegheny County – SWRO - January, 1992:** House explosion, resulting in destruction of residence, one injury and an area-wide evacuation. Origin/mechanism of migration is an operating gas well. Pressurization of the casing was the mechanism of migration of stray gas that caused the explosion. The well has been repaired. Status: Resolved

## **LEGACY OR ABANDONED WELL CASES**

**Hulton Road Migration, Westmoreland County – SWRO - October 2009:** This incident was first investigated in August of 2004. The stray gas occurs in the soils on private property and in the right of way of Hulton Road. Origin/mechanism of migration is an abandoned gas well. In 2009 the Department issued a contract to plug the suspected well and install venting.. Plugging the well did not alleviate the stray gas. The Department let another contract for an additional \$10,500 to vent the stay gas..



**128 Lilac Court Migration, Allegheny County – SWRO - June, 2009:** The stray gas occurs in the soils in a suburban housing development. Currently, the gas is localized in an area in front of a single residence. Origin/mechanism of migration is an abandoned gas well, location and mechanism of migration unknown. Status: Investigation ongoing.

**226 Thompson Run Road Migration, Allegheny County – SWRO - May, 2009:** The stray gas occurs in the soils in the vicinity of a residence. The area has had historical stray gas incidents. Venting systems have been installed at several locations in the area. Origin/mechanism of migration: source of gas is an abandoned gas well. Its location is unknown. DEP investigation is ongoing.

**Independent Valley News Migration, Allegheny County – SWRO - April, 2009:** The stray gas occurs in the soils in front of a business. The gas is being vented with a temporary vent system. Origin/mechanism of migration: source of stray gas is an abandoned gas well. Its location is known. The well has been placed on the list for plugging/venting. Status: DEP contractor to properly vent or plug suspect abandoned gas well.

**112 Buss Road Migration, Beaver County – SWRO - March, 2009:** The stray gas occurs in the soils on private property. Origin/mechanism of migration: source of gas is an abandoned gas well; its location is known. Status: The leaking gas well is being evaluated for proper venting/plugging.

**2526 Wexford Bayne Road Migration, Allegheny County – SWRO - March, 2009:** Stray gas in soils and inside home. Origin/mechanism of migration: abandoned gas well; its location is unknown. Natural gas service was terminated at a residence. Status: Resolved. The owner installed a venting/alarm system at his own expense.

**Wendt Drive Migration, Allegheny County – SWRO - June, 2009:** The stray gas occurs in the soils on private property. Origin/mechanism of migration: source of gas is an abandoned gas well. Its location is unknown. DEP investigation is ongoing.

**Charleroi Migration, Washington County – SWRO - March, 2009:** Stray gas encountered in soils in close proximity to business. Origin/mechanism of migration is an abandoned gas well. The operator of the well refused to accept responsibility for the problem and take corrective actions. Gas was leaking from the well in the parking lot and was adjacent to the buildings slab foundation. DEP issued a contract to plug the well and initially vented the well until work on plugging the well could begin. Plugging was recently completed. DEP will pursuing cost recovery from the operator.

**Tarentum Migration, Allegheny County – SWRO - March, 2005 to October 2009:**

This incident was initially investigated in March, 2005. Thermogenic source from an unknown location resulted in natural gas service to be terminated by the gas utility 3 years ago at 220 W. 7th Avenue. The DEP plugged one abandoned well. This well plugging did not alleviate the stray gas in the 7<sup>th</sup> avenue area. There was another plugged well nearby, but did not show any signs of a problem. DEP is conducting follow-up work to the plugging contract to vent the area adjacent to the structure. Origin/mechanism of migration: abandoned gas well, location unknown (contracting is awarded and work is about to begin).

**Versailles Migration, Versailles, Allegheny County – SWRO – 2007 through 2008:**

The natural gas migration problem in Versailles has been ongoing for many years. During the boom period from 1919 through 1921, over 175 wells were drilled in the Borough of Versailles which was part of the McKeesport Gas Field. Some wells produced little or no gas and were abandoned without casing or plugging the boreholes. Other wells produced for a few years and were also abandoned without plugging the wells. During World War II, the call for scrap steel resulted in the removal of steel casings and wellheads. The abandoned wells were cover over or otherwise abandoned. Over the years many venting systems have been installed by the property owners, borough or by DEP. In 2007 and 2008, the Department let an emergency contract to rehabilitate a well on the Saraka property for to relieve the natural gas pressure in the area. The DOE's National Energy Technology Laboratory (NETL) conducted an extensive study of the area. The original budget for the study was about \$1 million dollars. This case is ongoing.

**Buckner Migration, Washington County – SWRO - December, 2008:** The stray gas occurs in a private water supply well. Origin/mechanism of migration source of gas is an abandoned gas well. Its location is unknown. DEP is conducting an ongoing investigation. The water well has been properly vented. Stray gas was migrating into a residence. DEP discovered pathway into home. Gas appears to be migrating through an abandoned coal mine. Status Immediate danger resolved. Investigation as to specific source is ongoing.

**2228 Private Drive Migration, Fayette County – SWRO - October, 2008:** Stray gas in soils. Origin/mechanism of migration is an abandoned gas well. Its location is unknown. Status: Resolved. This case was resolved by venting gas away from the structure.

**630 Tara Court Migration, Ross Township, Allegheny County – SWRO - September 2008:** The source of gas is an abandoned gas well, probably located under the parking lot of the Ross Park Mall. Gas service was terminated at the house at 630 Tara Court in the adjacent subdivision. The Mall was contacted and they are to provide maps of the parking lot to help locate the abandoned wells. The stray gas problem at Tara Court was

resolved by installing a venting system until the abandoned wells under the parking lot can be located. The case is ongoing.

**Pottle Migration, Allegheny County – SWRO - October, 2007:** Stray gas discovered in soils at location for new commercial building. Origin/mechanism of migration is an abandoned gas well. Its location is unknown. Status: Resolved. The owners of a commercial building installed a mitigation/alarm system at their expense to resolve the problem.

**1100 McCartney Avenue Migration, Allegheny County – SWRO - February, 2007:** Stray gas along front of commercial business. The source of gas is an abandoned gas well; its location is unknown. The owner of the commercial building installed a mitigation/alarm system at his expense. Natural Gas service restored.

**Sturgeon Migration, Allegheny County – SWRO - September, 2005:** Stray gas in close proximity to several residences. Natural gas service terminated. Origin/mechanism of migration is an abandoned gas well. Its location is unknown. DEP installed a venting system to mitigate the gas migration problem at two residences. Status: Resolved. Gas service restored and the occupants returned to their residence. DEP investigated a well between the two properties; however, it was determined during preparations to plug the well that it was an old water well and not the source of gas.

**Childers Migration, Washington County – SWRO - June, 2005:** Stray gas has impacted soils area wide on private property. The source of gas is an abandoned gas well; its location is known. A gas well was leaking at the surface. There is a dispute of ownership with the well. The Department suspects the integrity of the well may have been affected by deep mining as the stray gas occurrence coincides with documented mine subsidence in the area.

Origin/mechanism of migration: abandoned gas well. Suspected casing/cement failure possible caused by mine subsidence. Status: Investigation Ongoing

**Mediate Migration, Westmoreland County – SWRO - November, 2003:** The stray gas was impacting private residence. Origin/mechanism of migration: source of gas is an abandoned gas well; its location is unknown. Natural gas service to a structure was terminated. Status: DEP funded mitigation system installed. Structure is protected. Natural gas service restored.

**Tanoma Migration, Indiana County – SWRO - July, 2001:** The stray gas occurs throughout the soils on private property. Origin/mechanism of migration: The origin of

the stray gas is likely coalbed/gas well mixture. The situation was resolved through venting. The specific sources have not identified. Status: Resolved

**McDonald Sr. Care Home Migration, Washington County – SWRO - November 2002:** Stray gas found inside a Senior Care home, resulted in temporary evacuation. Origin/mechanism of migration is an abandoned gas well. Its location is unknown. The home was evacuated. The problem was resolved by installation of a mitigation system.

**Paiano Migration, Armstrong County, -SWRO - September, 2002:** Stray gas inside private water supply well resulted explosion in well enclosure. No injuries. Well was properly vented. Origin/mechanism of migration is an abandoned gas well, location unknown. Status: Resolved. Water well properly vented. Well not found.

**Bagdad Road Migration, Waterford Twp., Erie County – NWRO – July 2008:** The Department is in the process of investigating a complaint of fugitive gas in a domestic water well received in July of 2008. All area gas wells are in regulatory compliance and isotopic analysis does not indicate a specific source of the stray thermogenic gas.

**Clarrington Migration, Barnett Twp., Clarion County - NWRO**  
The Department has been aware of a soil gas seep in a remote area since at least 1987. The source of the gas is unknown, no active gas wells are in the vicinity and a search of historical records failed to indicate any record of oil and gas drilling. The site near Cherry Run has become a seasonal camping spot and the surface expression of the stray gas migration has been improved with stone fire-ring to serve as a campfire location.

**Groshek Migration, Keating Twp., McKean County – NWRO – 2008.** In 2008 the Department responded to a complaint of stray gas in a domestic water supply. The area of the complaint is in an old oil and gas field that was drilled near the turn of the 20<sup>th</sup> century. Historic maps were used to attempt to locate nearby abandoned wells. Without any new drilling activity vicinity, the Department plugged four abandoned wells. These efforts of find and fix the cause of the migration have been unsuccessful. A recently discovered gas well has been identified in the field and the well was placed on the department's plugging list.

**Leichtenberger Migration, Howe Twp., Forest County - NWRO**  
In June 2005 stray gas was reported to have entered two springs that serve as domestic water supplies. Located in an area that experienced a long history of oil and gas drilling activity, it was discovered that the migration began near the same time that two gas wells, located more that 3000' away, were fraced. The new gas wells are in regulatory

compliance and additional measures were taken to prevent a gas migration. The department has plugged three abandoned gas wells in the vicinity. All efforts to identify the cause of the migration have been unsuccessful.

**Nicholls Migration, Rome Twp., Bradford County – NCRO – June 2007:** Complaint received by the Department in June, 2007 of stray gas in a domestic water supply. Isotopic analysis of the gas indicates that it is of thermogenic origin although it apparently does not match any production gas in nearby gas wells.

**Skinner Migration, Columbus Twp., Warren County - NWRO**

The Department responded to a complaint of stray gas in a domestic water well in June, 2005. All wells within 6000' were inspected and found to be in regulatory compliance except two gas wells. Those two wells were brought into compliance with the addition of production casing. The water supply improved however small amounts of fugitive gas remain in the water well. An abandoned well discovered by the department during the investigation remains on the State's plugging list.

**Wayland Road Gas Migration, East Mead Twp., Crawford County – NWRO –**

**October 2008:** The Department continues to investigate a fugitive gas migration expressed in a domestic water well first reported in October, 2008. No difficulties were reported by the drilling company during construction of nearby gas wells, all gas wells are in regulatory compliance and it is difficult to determine when the problem became apparent. Isotopic analysis indicates that the fugitive gas is thermogenic in origin although a match to a nearby gas well is not apparent.

**Hetrick Gas Migration, Redbank Twp., Clarion County – NWRO – Spring 2007:**

In the spring of 2007 the Department initiated an investigation into the conditions surrounding the report of fugitive gas in a domestic water well. Isotopic analysis of the stray gas indicates a thermogenic origin potentially similar to neighboring gas wells. A legally defensible case against a potentially responsible party could not be demonstrated and the Department eventually provided the resident with an alternative source of water.

**Julie Anne Lane, Summit Twp., Erie County – August 2008:** In August of 2008 the Department responded to a report of fugitive gas near a private residence. During the investigation a nearby "plugged" National Fuel Gas well was leaking a very small amount of gas. Isotopic analysis of soil gas samples obtained by the DEP indicated that the gas was probably of microbial origin and fuel gas was restored to the residence.

**Mainesburg Migration, Sullivan Twp., Tioga County – NWRO – 2004:** The Department became involved with this larger scale stray gas migration in 2004. Elevated

levels of fugitive gas were identified in approximately 15 residences. Through a joint action between the department and Township officials, and with funding through a Growing Greener Grant, treatment systems were placed on those affected water wells. Three abandoned gas wells were plugged by the Department.

**McCommons Migration, Leidy Twp., Clinton County – NWRO – November 1998:**

In November 1998 the Department responded to a complaint of stray gas in three water supply wells. Through the course of the investigation it was discovered that because one of the affected water wells was located in the basement of a church, combustible gas migrated from the well and into the indoor air of the structure, causing a significant risk of explosion. Also discovered was that during a recent resurfacing project on Rt. 144, PennDOT paved over an abandoned gas well. The Department proceeded to remove the recent pavement and plug the abandoned well. Two of the three impacted water wells returned to normal and a marked improvement in conditions were noted in the third water well.

**Mt. Jewett Municipal Well-field Migration, Hamlin Township, McKean County:**

Three water wells for the municipality of Mt. Jewett were temporarily affected by a stray gas occurrence in 2008. The migration lasted approximately one week and went away for no apparent reason. After the event, the department plugged a nearby abandoned gas well.

**Sara Coyne, City of Erie, Erie County – NWRO – April 2008:** In April of 2008, the department responded to a complaint of gas bubbling in a large body of standing water in a campground near the entrance to Presque Isle State Park. Soil gas samples obtained for isotopic analysis indicated that the composition of the gas is consistent with shallow shale gas of the area. Excavation done by the property owner encountered an abandoned gas well approximately 6 feet below ground surface. The gas well was subsequently plugged.

**Environmental Air Migration, Pittsburgh, Allegheny County**

The source of gas is an abandoned gas well; its location is unknown. Natural gas service was restored following installation of a mitigation system.

**Owens Migration, Allegheny County**

The source of gas is an abandoned gas well; its location is known. A site developer disturbed the well and was required to properly abandon the well.

**Marshall Avenue Migration, Chartiers, Washington County**

The source of gas is a possible coalbed/gas well mixture. The area has been properly vented. DEP suspects a gas well was leaking into a mine void.

**Elliot Migration, Armstrong County**

The source of gas is an abandoned gas well; its location is unknown. The case was resolved by properly venting a water well.

## **UNDERGROUND STORAGE OF NATURAL GAS CASES**

**Tioga Junction Migration, Tioga Twp., Tioga County – NWRO - 2008:** In January 2001, the Department responded to a report of gas in the soil near two buildings. Further investigation indicated the presence of a potentially widespread stray gas migration problem. In 2008, Dominion Transmission and PPL Gas Utilities Corp. initiate a voluntary program to ensure safe source of drinking water for residences near Tioga Storage Field. 288 letters were sent of area homeowners requesting the opportunity to sample individual water supplies. A large number of residents responded and the extent of the potential stray gas by sampling was delineated. Water treatment systems were provided, at no cost to the homeowner, to those water supplies that were shown to have been impacted. The companies and the Department remain in the investigation process.

**Sabinsville Migration, Borough of Sabinsville, Tioga County – NWRO – 2005 ongoing:** The Department is aware of a fugitive gas migration in the water supplies for several residences in Sabinsville. Initial sampling occurred in 2005 and elevated levels of methane/ethane were encountered. The homes are located within the footprint for the Sabinsville Gas Storage Field that is operated by Dominion Transmission Inc. Isotopic samples have been obtained from the affected water wells and gas wells within the storage field. The cause of the migration has not been determined.